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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B41M 3/00	A1	(11) International Publication Number: WO 92/00852 (43) International Publication Date: 23 January 1992 (23.01.92)
(21) International Application Number: PCT/US91/04662 (22) International Filing Date: 5 July 1991 (05.07.91) (30) Priority data: 549,600 9 July 1990 (09.07.90) US Not furnished 2 July 1991 (02.07.91) US (71) Applicant: SAWGRASS SYSTEMS , INC. d/b/a THE SAWGRASS CO. [US/US]; 782 Johnnie Dodds Boulevard, Mt. Pleasant, SC 29464 (US). (72) Inventor: HALE, Nathan ; 782 Johnnie Dodds Boulevard, Mt. Pleasant, SC 29464 (US). (74) Agent: KILLOUGH, B., Craig; 134 Meeting Street, Suite 200, Post Office Box 486, Charleston, SC 29402 (US).		(81) Designated States: AT, AU, BB, BG, BR, CA, CH, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MC, MG, + MW, NL, NO, PL, RO, SD, SE, SU. Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: TRANSFER PRINTING PROCESS (57) Abstract An image (3) is permanently printed on an object (8) by capturing the image (3) printing heat sensitive ink solids by thermal mean onto a medium (9) and then transferring the ink solids from the medium (9) to the object (8) by applying sufficient heat to the ink solids to cause the heat sensitive ink to permanently bond to the object (8) in the desired image (3). The heat sensitive transfer ink is printed onto the medium (9) by thermal printing means (10) at a temperature which will release and print the ink, but which is below the temperature which will cause the heat sensitive ink to bond permanently. The image (3) is then transferred from the medium (9) onto the object (8) at a higher temperature which will cause the sensitive ink to permanently bond to the object (8).		

+ DESIGNATIONS OF "SU"

It is under examination in which parts of the former Soviet Union the designation of the Soviet Union has effect.

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TRANSFER PRINTING PROCESS

BACKGROUND OF THE INVENTION

This invention relates to printing generally and more specifically relates to a method of transferring a design onto an object by means of printing heat sensitive ink in the desired design onto paper or other printable material by thermal means at a relatively low temperature, then transferring the design from the paper or printable material to an object on which the design is to permanently appear at a higher temperature which will cause the heat sensitive ink to bond to the object.

Words and designs are frequently printed onto clothing and other textile materials, as well as other objects. Common means of applying such designs to objects include the use of silk screens, and mechanically bonded thermal transfers. Silk screen process is well known in the art, and a mechanical thermal process to textile materials is described in Hare, U.S. Patent Number 4,244,358.

The use of computer technology has allowed almost instantaneous printing of images. For example, video cameras or scanning may be used to capture an image on magnetic media such as computer hard disks or floppy disks. The image may then be printed by any suitable printing means, including mechanical thermal printers, wet printed (inkjet) heat sensitive transfers and laser printers.

The process of thermal transfers by mechanical means is described in Hare, U.S. Patent Number 4,773,953. The art, as developed under this patent, is well known and defined in practice. The resulting mechanical image, as transferred, is a surface bonded image with a raised plastic like feel to the surface. The

1 resulting printed image is stiff to the feel, has poor dimensional
2 stability when stretched and poor color range.

3 Certain ink solids bond to or dye fabrics or other materials
4 as a result of the application of heat. These ink solids liquify
5 or sublimate upon the application of heat. Sublimation ink solids
6 have been applied from pre-printed media, but the printing of such
7 media with heat sensitive inks has not been done by thermal means
8 at a temperature lower than that which activates the heat sensitive
9 ink.

10 Sublimation ink solids change to a gas typically in a range of
11 140°F - 500°F, depending upon the particular ink solid chosen. Once
12 the sublimation occurs, bonding of the ink solid to the application
13 takes place, the ink is permanent and highly resistant to change or
14 fading caused by laundry products.

15 SUMMARY OF THE PRESENT INVENTION

16 The present invention uses ink solids which may be affixed to
17 an object by applying heat. This heat sensitive ink solid is
18 transferred in the desired design by means of a thermal printer
19 onto a medium, which will most commonly be paper. This initial
20 thermal printing takes place at a temperature which is below that
21 which will liquefy or sublimate the ink solid.

22

1 The image is then transferred from the medium onto the desired
2 material. Dye diffusion, sublimation or other activation of the
3 heat sensitive ink solid does not take place at the time of
4 transfer from the ribbon to the print medium, but rather takes
5 place at the time of the transfer of the image from the medium to
6 the object onto which the image is to be applied. Accordingly, a
7 higher temperature is used to apply the image from the medium than
8 is used to print the image onto the medium.

9 The present invention allows the desired image to be
10 transferred onto a medium almost instantaneously from the creation
11 of the image. This image may be then permanently transferred from
12 the medium onto the object on which it is to be displayed either at
13 the same time, or "stored" by means of the medium to be permanently
14 applied later as desired.

15 The process allows relatively low volumes of the design to be
16 produced and printed onto a medium by thermal printing means using
17 heat sensitive ink solids. By heat activating the heat sensitive
18 transfer ink solids at the time of application of the image onto
19 the object on which it is displayed, the design has a look of being
20 "dyed in" when applied to a textile material. The image does not
21 look or feel as though it has been topically applied. The image
22 will stretch and move as the fabric moves, and is permanently
23 affixed to the object.

1 pass" (three color) may be preferred.

2 In the present invention, ink solids are used, and are
3 transferred to a medium in a dry, solid form by the printer. In
4 the preferred embodiment, the heat sensitive transfer ink solids
5 are transferred onto the medium, such as paper, by the printer from
6 a ribbon on which the ink solids are bound.

7 The ribbon to be used with the printer may be a polyester
8 ribbon. The dry ink solids may be retained on the polyester ribbon
9 by the use of wax. The printer, such as a thermal printer, will
10 transfer the ink in the desired design and colors from the ribbon
11 to the medium at a temperature which is sufficient to release the
12 ink solids from the binder, such as wax, but which is below the
13 temperature which will cause any substantial liquification or
14 sublimation of the ink solids. Typically, the binder will melt in
15 a range of 130°F to 225°F, so that the thermal printing of the ink
16 solids onto the medium will take place within this range. The
17 temperature range will, however, be dependent on the thermal
18 printing means.

19 The quality of the image is achieved in part through the use
20 of a means such as a ribbon to which the heat sensitive transfer
21 ink solids are bonded by means of wax. The wax is melted by the
22 thermal printer, which releases not only the ink solids, but also
23 the wax, some of which is transferred to the medium. The wax aids
24 in holding the heat sensitive transfer ink solids on the medium in
25 the precise design, eliminating the need for special paper, while
26 also producing an image which has high resolution.

1 Virtually any material may be used as a medium which can be
2 printed upon by a printer, and which will withstand the higher
3 transfer temperature, as is described herein. If a thermal printer
4 is used, this medium may be any paper commonly used with thermal
5 printers, however, standard bond paper could be used. Other
6 materials, such as a sheet of metal could be used, if the metal
7 sheet can be printed upon by the particular thermal printer
8 employed.

9 Once the image is transferred onto the medium, the image may
10 be permanently transferred onto an object presently, or at a later
11 time. Most commonly, the design will be transferred onto a textile
12 material, such as a shirt 8, although the image may be transferred
13 onto other materials, such as metal, wood, or plastic

14 The design 3, which is printed onto the medium 9, is placed
15 against the object 8. A temperature which is sufficient to
16 sublimate the ink solids or cause diffusion or other activation of
17 the ink solids is then applied to the medium. A heat transfer
18 machine 10 may be used to accomplish the transfer process.

19 The ink which is chosen is heat sensitive. The application of
20 the relatively high heat of the transfer process causes a diffusion
21 of the ink, or causes a sublimation of the ink, depending upon the
22 particular ink chosen. For example, if a sublimation ink is
23 chosen, it should be one which will sufficiently sublimate at a
24 temperature above the temperature used to thermally print onto the
25 medium so as to produce a good quality image. By way of example,
26 a binder is chosen which will release the ink onto the medium by

1 the thermal printer at around 200°F, while the transfer from the
2 medium to the object will take place at around 400°F. In terms of
3 a range, the thermal printing will typically take place at 130°F to
4 225°F, while the transfer will take place at 250°F to 500°F.
5 However, if the thermal printing temperature is too close to the
6 sublimation temperature, excessive sublimation may take place
7 during the thermal printing process, and the ultimate print quality
8 may not be acceptable. Therefore, the thermal printing temperature
9 must be sufficient to properly release the ink, and the ink chosen
10 should not have noticeable sublimation at the temperature at which
11 thermal printing takes place. For other types of heat sensitive
12 inks other than sublimation ink solids, these principles are the
13 same. The thermal printing temperature must be below that at which
14 diffusion ink solids will dye a textile material, for example.

WHAT IS CLAIMED IS:

1. A method of printing a design using heat sensitive ink solids, comprising the steps of:

- a. printing by thermal means heat sensitive ink solids in a desired design onto a medium at a temperature which is below the temperature at which said ink solids are activated; and
- b. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said ink activates, so as to cause said ink to transfer onto said object from said medium in the desired design.

2. A method of printing a design using heat sensitive ink solids, comprising the steps of:

- a. creating an image;
- b. printing by thermal means heat sensitive ink solids in a desired design onto a medium at a temperature which is below the temperature at which said ink solids diffuse or sublimate; and
- c. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said ink diffuses or sublimates, so as to cause said ink to transfer onto said object from said medium in the desired design.

3. A method of printing a design using heat sensitive ink solids, comprising the steps of:

- a. printing by thermal means heat sensitive ink solids from a ribbon to which said ink solids are bound by means of a binder, at a temperature which is below the temperature at which said ink solids diffuse or sublimate, but at a temperature which is sufficient to cause said ink solids to be released from said binder onto said medium in a desired design; and
- b. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said ink solids diffuse or sublimate, so as to cause said ink solids to transfer onto said object from said medium in the desired design.

4. A method of printing a design using sublimation ink solids, comprising the steps of:

- a. printing by thermal means sublimation ink solids in a desired design onto a medium at a temperature which is below the temperature at which said sublimation ink solids sublimate; and
- b. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said

sublimation ink solids sublimate, so as to cause said sublimation ink solids to transfer onto said object.

5. A method of printing a design using sublimation ink solids, comprising the steps of:

- a. creating an image;
- b. printing by thermal means sublimation ink solids in a desired design onto a medium at a temperature which is in a range of temperatures below the temperature at which said sublimation ink solids sublimate and above the temperature which will cause said ink solids to be transferred to said medium; and
- c. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said sublimation ink solids sublimate, so as to cause said sublimation ink solids to transfer onto said object.

6. A method of printing a design using sublimation ink solids, comprising steps the of:

- a. printing by thermal means sublimation ink solids from a ribbon to which said ink solids are bound by means of wax at a temperature which is below the temperature at which said sublimation ink solids sublimate, but at a temperature which is sufficient to cause said ink solids

to be released from said binder onto said medium in a desired design; and

- b. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said sublimation ink solids sublime, so as to cause said sublimation ink solids to transfer onto said object.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/04662

I. CLASSIFICATION F SUBJECT MATTER (if several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): B41M 3/00

US CL : 156/230,240,583.1

II. FIELDS SEARCHED

Minimum Documentation Searched ⁷

Classification System

Classification Symbols

U.S.

156/230,240,583.1

8/471 346/76PH

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ⁸

III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US, A, 4,874,454 (TALALAY ET AL) 17 OCTOBER 1989 See entire document.	1-6
Y	US, A, 4,561,789 (SAITO) 31 DECEMBER 1985 See entire document.	1-6
A	US, A, 4,558,329 (HONDA) 10 DECEMBER 1985 See entire document.	1-6
A	US, A, 4,021,591 (DeVRIES ET AL.) 03 MAY 1977 See entire document.	1-6

* Special categories of cited documents: ¹⁰

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the international Search

Date of Mailing of this International Search Report

18 OCTOBER 1991

12 NOV 1991

International Searching Authority

Signature of Authorized Officer

ISA/US

JAMES ENGEL

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**CORRECTED
VERSION ***

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WORLD INTELLECTUAL PROPERTY ORGANIZATION
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B41M 3/00	A1	(11) International Publication Number: WO 92/00852 (43) International Publication Date: 23 January 1992 (23.01.92)
(21) International Application Number: PCT/US91/04662 (22) International Filing Date: 5 July 1991 (05.07.91) (30) Priority data: 549,600 9 July 1990 (09.07.90) US Not furnished 2 July 1991 (02.07.91) US (71) Applicant: SAWGRASS SYSTEMS, INC. d/b/a THE SAWGRASS CO. [US/US]; 782 Johnnie Dodds Boulevard, Mt. Pleasant, SC 29464 (US). (72) Inventor: HALE, Nathan ; 782 Johnnie Dodds Boulevard, Mt. Pleasant, SC 29464 (US). (74) Agent: KILLOUGH, B., Craig; 134 Meeting Street, Suite 200, Post Office Box 486, Charleston, SC 29402 (US).		(81) Designated States: AT, AU, BB, BG, BR, CA, CH, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MC, MG, MW, NL, NO, PL, RO, SD, SE, SU. Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
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DK	Denmark			US	United States of America

TRANSFER PRINTING PROCESS

BACKGROUND OF THE INVENTION

This invention relates to printing generally and more specifically relates to a method of transferring a design onto an object by means of printing heat sensitive ink in the desired design onto paper or other printable material by thermal means at a relatively low temperature, then transferring the design from the paper or printable material to an object on which the design is to permanently appear at a higher temperature which will cause the heat sensitive ink to bond to the object.

Words and designs are frequently printed onto clothing and other textile materials, as well as other objects. Common means of applying such designs to objects include the use of silk screens, and mechanically bonded thermal transfers. Silk screen process is well known in the art, and a mechanical thermal process to textile materials is described in Hare, U.S. Patent Number 4,244,358.

The use of computer technology has allowed almost instantaneous printing of images. For example, video cameras or scanning may be used to capture an image on magnetic media such as computer hard disks or floppy disks. The image may then be printed by any suitable printing means, including mechanical thermal printers, wet printed (inkjet) heat sensitive transfers and laser printers.

The process of thermal transfers by mechanical means is described in Hare, U.S. Patent Number 4,773,953. The art, as developed under this patent, is well known and defined in practice. The resulting mechanical image, as transferred, is a surface bonded image with a raised plastic like feel to the surface. The

1 resulting printed image is stiff to the feel, has poor dimensional
2 stability when stretched and poor color range.

3 Certain ink solids bond to or dye fabrics or other materials
4 as a result of the application of heat. These ink solids liquify
5 or sublimate upon the application of heat. Sublimation ink solids
6 have been applied from pre-printed media, but the printing of such
7 media with heat sensitive inks has not been done by thermal means
8 at a temperature lower than that which activates the heat sensitive
9 ink.

10 Sublimation ink solids change to a gas typically in a range of
11 140°F - 500°F, depending upon the particular ink solid chosen. Once
12 the sublimation occurs, bonding of the ink solid to the application
13 takes place, the ink is permanent and highly resistant to change or
14 fading caused by laundry products.

15 SUMMARY OF THE PRESENT INVENTION

16 The present invention uses ink solids which may be affixed to
17 an object by applying heat. This heat sensitive ink solid is
18 transferred in the desired design by means of a thermal printer
19 onto a medium, which will most commonly be paper. This initial
20 thermal printing takes place at a temperature which is below that
21 which will liquefy or sublimate the ink solid.

22

1 The image is then transferred from the medium onto the desired
2 material. Dye diffusion, sublimation or other activation of the
3 heat sensitive ink solid does not take place at the time of
4 transfer from the ribbon to the print medium, but rather takes
5 place at the time of the transfer of the image from the medium to
6 the object onto which the image is to be applied. Accordingly, a
7 higher temperature is used to apply the image from the medium than
8 is used to print the image onto the medium.

9 The present invention allows the desired image to be
10 transferred onto a medium almost instantaneously from the creation
11 of the image. This image may be then permanently transferred from
12 the medium onto the object on which it is to be displayed either at
13 the same time, or "stored" by means of the medium to be permanently
14 applied later as desired.

15 The process allows relatively low volumes of the design to be
16 produced and printed onto a medium by thermal printing means using
17 heat sensitive ink solids. By heat activating the heat sensitive
18 transfer ink solids at the time of application of the image onto
19 the object on which it is displayed, the design has a look of being
20 "dyed in" when applied to a textile material. The image does not
21 look or feel as though it has been topically applied. The image
22 will stretch and move as the fabric moves, and is permanently
23 affixed to the object.

DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram showing the printing process.

Figure 2 illustrates an example of a design printed by a printer using the printing process.

Figure 3 is a diagram illustration showing exemplary elements of computer and printing systems which could be used to achieve the printing process.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In the preferred embodiment, a video camera or scanning device 2 may be used to capture an image 3. This image is then input into a computer 4. The computer directs a thermal printer 6 to print the image.

Any means of inputting an image into a computer may be used. Available computer design graphic software may be used, or still photography may be used. The design may be photographic, graphic artistic, or simply letters or words.

Virtually any thermal printer which will print in response to a computer may be used. In most applications, a printer which will print in multiple colors is desirable. A thermal printer which will print in what is known as "four pass" (four color) or "three

1 pass" (three color) may b preferred.

2 In the present invention, ink solids are used, and are
3 transferred to a medium in a dry, solid form by the printer. In
4 the preferred embodiment, the heat sensitive transfer ink solids
5 are transferred onto the medium, such as paper, by the printer from
6 a ribbon on which the ink solids are bound.

7 The ribbon to be used with the printer may be a polyester
8 ribbon. The dry ink solids may be retained on the polyester ribbon
9 by the use of wax. The printer, such as a thermal printer, will
10 transfer the ink in the desired design and colors from the ribbon
11 to the medium at a temperature which is sufficient to release the
12 ink solids from the binder, such as wax, but which is below the
13 temperature which will cause any substantial liquification or
14 sublimation of the ink solids. Typically, the binder will melt in
15 a range of 130°F to 225°F, so that the thermal printing of the ink
16 solids onto the medium will take place within this range. The
17 temperature range will, however, be dependent on the thermal
18 printing means.

19 The quality of the image is achieved in part through the use
20 of a means such as a ribbon to which the heat sensitive transfer
21 ink solids are bonded by means of wax. The wax is melted by the
22 thermal printer, which releases not only the ink solids, but also
23 the wax, some of which is transferred to the medium. The wax aids
24 in holding the heat sensitive transfer ink solids on the medium in
25 the precise design, eliminating the need for special paper, while
26 also producing an image which has high resolution.

1 Virtually any material may be used as a medium which can be
2 printed upon by a printer, and which will withstand the higher
3 transfer temperature, as is described herein. If a thermal printer
4 is used, this medium may be any paper commonly used with thermal
5 printers, however, standard bond paper could be used. Other
6 materials, such as a sheet of metal could be used, if the metal
7 sheet can be printed upon by the particular thermal printer
8 employed.

9 Once the image is transferred onto the medium, the image may
10 be permanently transferred onto an object presently, or at a later
11 time. Most commonly, the design will be transferred onto a textile
12 material, such as a shirt 8, although the image may be transferred
13 onto other materials, such as metal, wood, or plastic

14 The design 3, which is printed onto the medium 9, is placed
15 against the object 8. A temperature which is sufficient to
16 sublimate the ink solids or cause diffusion or other activation of
17 the ink solids is then applied to the medium. A heat transfer
18 machine 10 may be used to accomplish the transfer process.

19 The ink which is chosen is heat sensitive. The application of
20 the relatively high heat of the transfer process causes a diffusion
21 of the ink, or causes a sublimation of the ink, depending upon the
22 particular ink chosen. For example, if a sublimation ink is
23 chosen, it should be one which will sufficiently sublimate at a
24 temperature above the temperature used to thermally print onto the
25 medium so as to produce a good quality image. By way of example,
26 a binder is chosen which will release the ink onto the medium by

1 the thermal printer at around 200°F, while the transfer from the
2 medium to the object will take place at around 400°F. In terms of
3 a range, the thermal printing will typically take place at 130°F to
4 225°F, while the transfer will take place at 250°F to 500°F.
5 However, if the thermal printing temperature is too close to the
6 sublimation temperature, excessive sublimation may take place
7 during the thermal printing process, and the ultimate print quality
8 may not be acceptable. Therefore, the thermal printing temperature
9 must be sufficient to properly release the ink, and the ink chosen
10 should not have noticeable sublimation at the temperature at which
11 thermal printing takes place. For other types of heat sensitive
12 inks other than sublimation ink solids, these principles are the
13 same. The thermal printing temperature must be below that at which
14 diffusion ink solids will dye a textile material, for example.

WHAT IS CLAIMED IS:

1. A method of printing a design using heat sensitive ink solids, comprising the steps of:
 - a. printing by thermal means heat sensitive ink solids in a desired design onto a medium at a temperature which is below the temperature at which said ink solids are activated; and
 - b. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said ink activates, so as to cause said ink to transfer onto said object from said medium in the desired design.
2. A method of printing a design using heat sensitive ink solids, comprising the steps of:
 - a. creating an image;
 - b. printing by thermal means heat sensitive ink solids in a desired design onto a medium at a temperature which is below the temperature at which said ink solids diffuse or sublimate; and
 - c. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said ink diffuses or sublimates, so as to cause said ink to transfer onto said object from said medium in the desired design.

3. A method of printing a design using heat sensitive ink solids, comprising the steps of:

- a. printing by thermal means heat sensitive ink solids from a ribbon to which said ink solids are bound by means of a binder, at a temperature which is below the temperature at which said ink solids diffuse or sublimate, but at a temperature which is sufficient to cause said ink solids to be released from said binder onto said medium in a desired design; and
- b. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said ink solids diffuse or sublimate, so as to cause said ink solids to transfer onto said object from said medium in the desired design.

4. A method of printing a design using sublimation ink solids, comprising the steps of:

- a. printing by thermal means sublimation ink solids in a desired design onto a medium at a temperature which is below the temperature at which said sublimation ink solids sublimate; and
- b. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said

sublimation ink solids sublimate, so as to cause said sublimation ink solids to transfer onto said object.

5. A method of printing a design using sublimation ink solids, comprising the steps of:

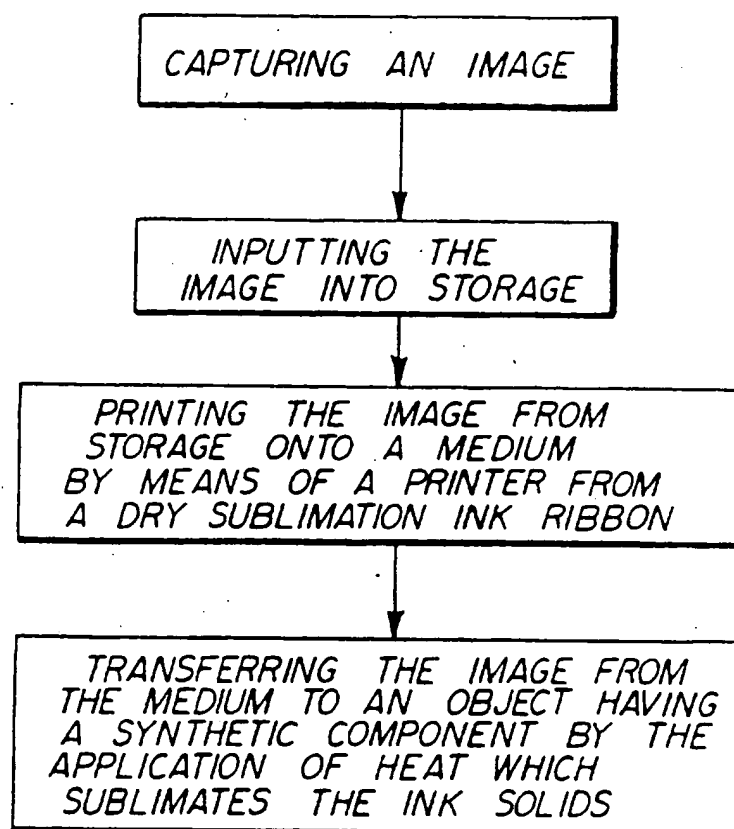
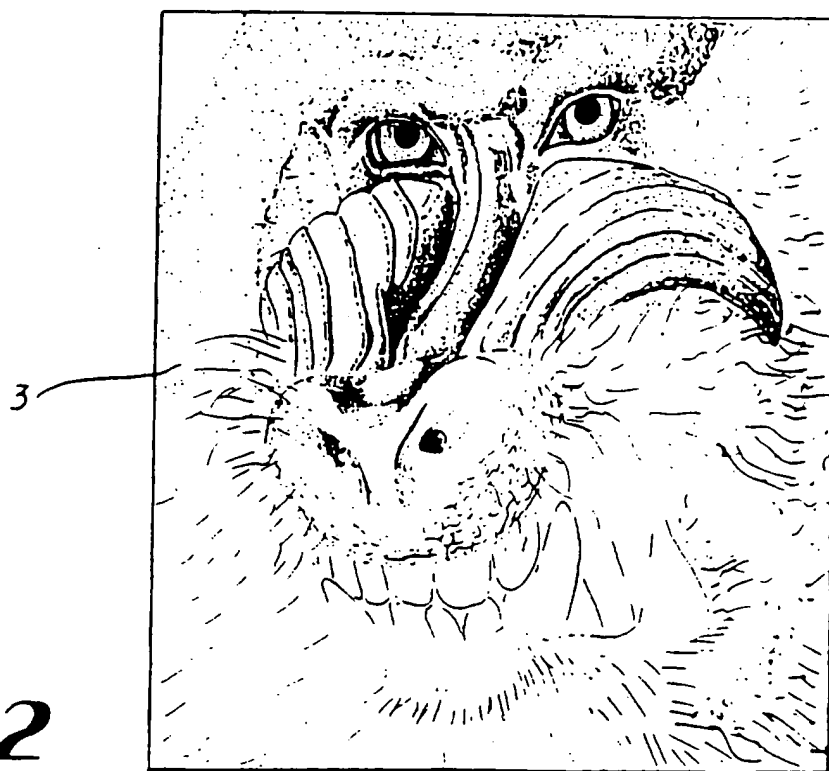
- a. creating an image;
- b. printing by thermal means sublimation ink solids in a desired design onto a medium at a temperature which is in a range of temperatures below the temperature at which said sublimation ink solids sublimate and above the temperature which will cause said ink solids to be transferred to said medium; and
- c. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said sublimation ink solids sublimate, so as to cause said sublimation ink solids to transfer onto said object.

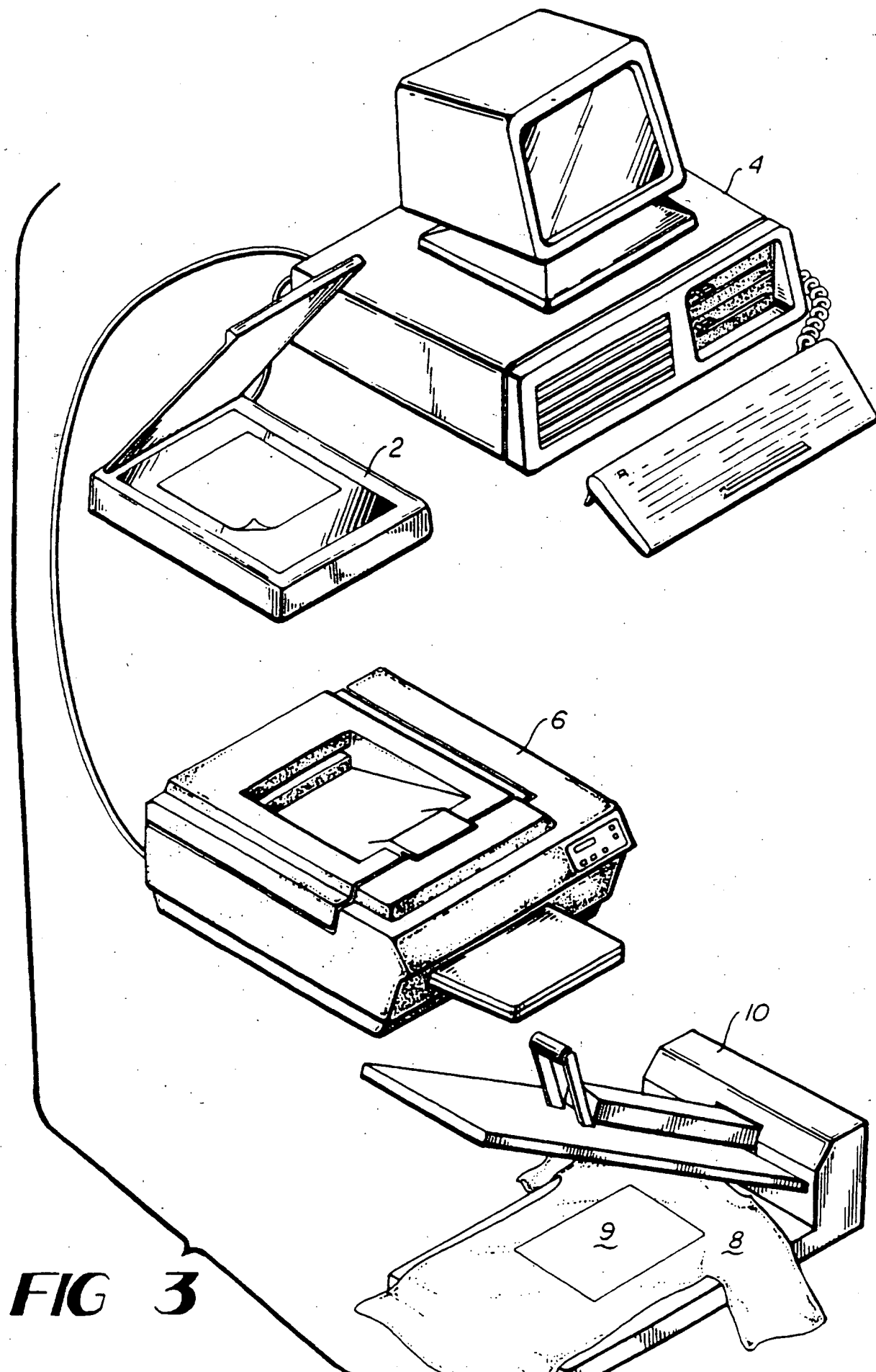
6. A method of printing a design using sublimation ink solids, comprising steps the of:

- a. printing by thermal means sublimation ink solids from a ribbon to which said ink solids are bound by means of wax at a temperature which is below the temperature at which said sublimation ink solids sublimate, but at a temperature which is sufficient to cause said ink solids

to be released from said binder onto said medium in a desired design; and

- b. transferring said image from said medium to an object on which the image is to appear by thermal means at a temperature which is above the temperature at which said sublimation ink solids sublime, so as to cause said sublimation ink solids to transfer onto said object.

**FIG 1****FIG 2**



INTERNATIONAL SEARCH REPORT

International Application No. **PCT/US91/04662**

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): **B41M 3/00**

US CL : **156/230,240,583.1**

II. FIELDS SEARCHED

Minimum Documentation Searched †

Classification System

Classification Symbols

U.S. **156/230,240,583.1**
 8/471 346/76PH

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ‡

III. DOCUMENTS CONSIDERED TO BE RELEVANT †

Category *	Citation of Document, †† with indication, where appropriate, of the relevant passages ‡‡	Relevant to Claim No. ‡‡
Y	US, A, 4,874,454 (TALALAY ET AL) 17 OCTOBER 1989 See entire document.	1-6
Y	US, A, 4,561,789 (SAITO) 31 DECEMBER 1985 See entire document.	1-6
A	US, A, 4,558,329 (HONDA) 10 DECEMBER 1985 See entire document.	1-6
A	US, A, 4,021,591 (DeVRIES ET AL.) 03 MAY 1977 See entire document.	1-6

* Special categories of cited documents: †‡

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"A" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

Date of Mailing of this International Search Report

18 OCTOBER 1991

International Searching Authority

ISA/US

12 NOV 1991

Signature of Authorized Officer

James Engel
JAMES ENGEL